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(19)

(54) OPTICAL FIRE DETECTOR

(71) We, TELEFONAKTIEBOLAGET L M ERICSSON, a company organized under the laws of Sweden, of S-126 25 Stockholm, Sweden,

do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an optical fire detector.

In Swedish Patent Specification No. 335,080, an optical fire detector is described in which a reduced sensitivity to disturbances is obtained by dividing a beam of radiation into two parallel beams of radiation which pass separate measuring chambers in order to be influenced differently by a fire and the intensities of which are measured separately and are compared mutually, an alarm being provided upon a predetermined difference between them.

British Patent Specification No. 1,405, 615 describes an optical fire detector which can use an arbitrary measuring chamber, for example a chamber guarded in that a beam of radiation is arranged to pass across it. Here a reduced sensitivity to disturbances is obtained by using a source of radiation which is intensity modulated at a definite frequency and a radiation detector which is frequency selective with respect to the frequency of the intensity modulation of the radiation source. This type of optical fire detector is suitable to respond to heat as well as to smoke.

According to this invention there is provided an optical fire detector including radiation-emitting means for emitting a beam of radiation and radiation-detecting means for receiving such radiation after it has passed through an intermediate air medium and providing an alarm in response to a predetermined obscuration of the beam of radiation, the radiation-detecting means comprising first means, for individually measuring the intensity in first and second wave-length bands of the beam of radiation, and second means, for comparing the individually measured intensities and providing the said alarm in response to a predetermined difference between them, in which detector the said first means includes radiation-sensing means arranged for alternately being connected to first and second inputs of the said second means, at least one of the inputs being provided with a memory, and third means is arranged for alternately dividing the beam of radiation into said two wavelength bands in synchronism with the alternating connection of the radiation-sensing means.

The invention will now be described by way of example to the accompanying drawing, in which Figures 1 to 3 show different embodiments of an optical fire detector, the Figure 1 embodiment not being in accordance with the invention.

Figure 1 shows an optical fire detector in which radiation-emitting means 1 comprises an incandescent lamp 2 connected to a voltage source 3 for emitting an outgoing beam of radiation, and radiation-detecting means 4 is arranged for receiving an incoming beam of radiation provided by reflection of the outgoing beam of radiation via a reflector (not shown) located at a distance and for providing an alarm upon a partial obscuration of the incoming beam of radiation. The radiation-detecting means 4 comprises two radiation-sensing means 5 and 6 arranged for a selective measurement of the intensity in first and second wavelength bands respectively of the beam of radiation. For this purpose, a dichroic filter 7 is placed in front of the radiation-sensing means 5 in the path of the incoming beam of radiation and is at an angle of 45 degrees relative thereto, the second radiation-sensing means 6 being placed in the path of a portion of the incoming beam

of radiation reflected by the dichroic filter 7. The dichroic filter 7 passes, for example, longer wavelength radiation to the radiation-sensing means 5 and reflects shorter wavelength radiation to the radiation-sensing means 6. The latter is connected to comparator means 8 arranged for comparing their measures of the intensities of the respective beams of radiation and providing an alarm upon a predetermined difference between these intensities.

Figure 2 shows an optical fire detector according to Figure 1 in which radiation detecting means 9 utilizes only one radiation-sensing means 10 arranged for alternatively being connected, through a switch 11, to first and second inputs of comparator means 12 having the same function as the comparator means 8 in Figure 1 but being provided with a memory at each input in the form of capacitors 13 and 14 respectively. Radiation-emitting means 15 has two incandescent lamps 16 and 17 arranged for alternatively, in synchronism with the alternating connection of the radiation-sensing means 10 to the comparator means 12, being connected to a voltage source 18 through a switch 19. In order to achieve that an outgoing beam of radiation from the radiation-emitting means will include two timed-multiplexed first and second wavelength bands, a dichroic filter 20 like the filter 7 in Figure 1 is placed in the path of the outgoing beam of radiation from the incandescent lamp 16 and is at an angle of 45° relative thereto, the other incandescent lamp 17 being placed so that its outgoing beam of radiation is reflected out by the dichroic filter 20 in the same path as the outgoing beam of radiation from the incandescent lamp 16. The switches 11 and 19 are connected in common via a respective control input to an output of an external clock pulse generator 21 in order to obtain the synchronous function.

Figure 3 shows an optical fire detector in which radiation-emitting means 22 corresponds to the radiation-emitting means 1 in Figure 1 and radiation-detecting means 23 utilizes only one radiation-sensing means 24 arranged to be alternately connected through a switch 25 to first and second inputs of comparator means 26 having the same function as the comparator means 8 in Figure 1, the comparator means 12 in Figure 2 being provided with a memory for each input in the form of capacitors 27 and 28 respectively. An optical interference filter 29 has an electric control input 30 which is connected in common with a control input 31 of the switch 25 to an output of a clock pulse generator 32 in order to achieve that the radiation-sensing means 24 will receive a beam of radiation which is generated by reflection of an outgoing beam of radiation from the radiation-emitting means 22 and includes first and second wavelength bands which are time-multiplexed by the interference filter 29 in synchronism with the alternating connection of the radiation-sensing means 24 to the comparator means 26. The interference filter 29 is for example of such a type that is described in the Journal "Electronics Letters" (GB), Vol 11, No. 19, 18th Sept. 1975, pp 471-2.

In the above embodiments, a selective measurement of the intensity is made within first and second wavelength bands of a beam of radiation after this has passed through an intermediate air medium and the measured intensities are mutually compared an alarm being provided upon a predetermined difference between these intensities. Thus they are based on the knowledge that fire gases obscure a beam of radiation differently in separate wavelength bands. An early alarm can be provided upon a fire by making a suitable choice of the wavelength bands. Upon the combustion of, for example, polyvinyl chloride substances, an early alarm is obtained if one of the wavelength bands is limited to the narrow interval 1.7-1.8 μm.

The sensitivity to disturbances may be minimized by the radiation-emitting means being intensity modulated and the radiation-detecting means being made frequency selective with reference to the frequency of the intensity modulation of the radiation-emitting means.

The described embodiments could be modified in several ways. For example, the incandescent lamps 16 and 17 and the dichroic filter 20 in Figure 2 could be replaced by two light-emitting diodes arranged to emit green and red light respectively and to be alternately connected to the voltage source 18 through the switch 19. A further possibility is to replace these two light-emitting diodes with only one light-emitting diode having a so-called multi-dichroic operation and produced in a monolythic substrate and arranged to be alternately, and in synchronism with the alternating connection of the radiation-sensing means 10 to the comparator means 12, connected to first and second voltages providing outgoing radiation within first and second wavelength bands respectively.

WHAT WE CLAIM IS:—

1. An optical fire detector including radiation-emitting means for emitting a beam of radiation and radiation-detecting means for receiving such radiation after it has passed through an intermediate air medium and providing an alarm in response to a predetermined obscuration of the beam of radiation, the radiation-detecting means comprising first means, for individually

measuring the intensity in first and second wavelength bands of the beam of radiation, and second means, for comparing the individually measured intensities and providing the said alarm in response to a predetermined difference between them, in which detector the said first means includes radiation-sensing means arranged for alternately being connected to first and second inputs of the said second means, at least one of the inputs being provided with a memory, and third means is arranged for alternately dividing the beam of radiation into said two wavelength bands in synchronism with the alternating connection of the radiation-sensing means.

2. A detector according to claim 1, wherein the said third means is included in the radiation-emitting means and comprises two radiation-emitting devices which are arranged for alternately being activated for an emission within the said first and second wavelength bands respectively.

3. A detector according to claim 1, wherein the said third means is included in the radiation-detecting means and comprises an optical filter which is electrically tunable for alternately transmitting within the said first and second wavelength bands respectively.

4. An optical fire detector, substantially in accordance with any example herein described with reference to Figure 2 or Figure 3 of the accompanying drawing.

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1 SHEET
This drawing is a reproduction of the Original on a reduced scale

Fig. 1

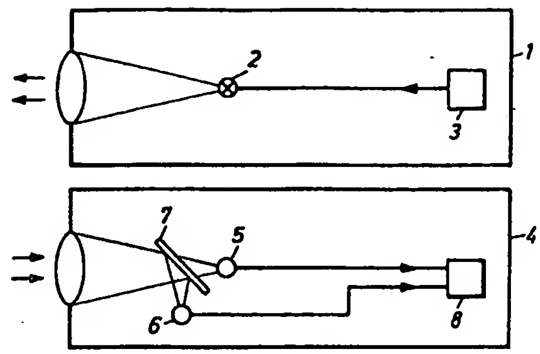

Fig. 2

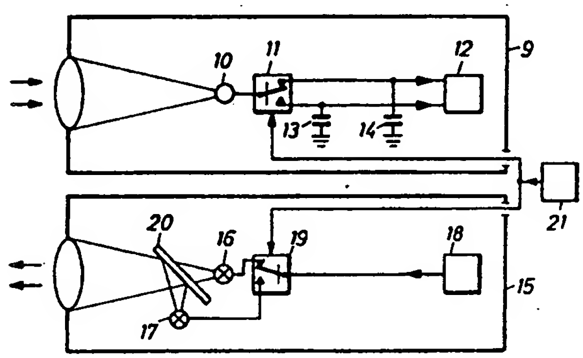

Fig. 3